REMARKS

Reconsideration of the subject invention, as mended, is respectfully requested. Claims 1-44 are pending in the application. Claims 31-43 are withdrawn from consideration due to an election of claims. Claims 1-30 and 44 stand rejected as communicated by the Office Action of 08/21/2003. By this Amendment, Claims 1 – 4; 6 – 11; 13 – 19; 20 – 28; 44 are withdrawn. Claims 5, 12, 19 and 29 are amended. Further, by this Amendment, New Claims 45 – 49 are added.

In the Office Action, the Official Draftsperson objected to the Drawings under 37 C.F.R. § 1.84, as follows:

10. CHARACTER OF LINES, NUMBER & LETTERS. 37 CFR 1.84(l). Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (poor line quality). Fig(s) 1 – 6.

12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p). Numbers and reference characters not plain and legible. Figs(s) 1 – 6 .

FORMAL CORRECTED DRAWINGS complying with the regulations will be forwarded to the Draftsperson at the appropriate time.

Claims 1- 30 and 44 of the subject patent application are rejected by the Office Action of 08/21/2003. Claims 1-30 and 44 were rejected, as communicated by the Office Action of 08/21/2003, under 35 U.S.C. §

102(b), as being anticipated by Henault "A Computer Simulation Study and Component Evaluation for Quaternion Filter for Sourceless Tracking of Human Limb Segment Motion".

The applicants respectfully traverse the 35 U.S.C. § 102(b) rejection and offer the following arguments for consideration.

It is well established that the present invention is distinguished from Henault unless each and every element and limitation of the present claims are recited in the referenced document.

Claims 1-30 and 44 are pending, following an earlier Election of Species.

The Examiner has rejected Claims 1-30 and 44 under 35 U.S.C. 102(b) as being anticipated by "A computer Simulation Study and Component Evaluation for a Quaternion Filter for Sourceless Tracking of Human Limb Segment Motion", Henault.

The Examiner in referring to claims 1 and 8, stated that "Henault disclosed a method of tracking the orientation of a sensor, the method comprising: a) measuring an angular velocity of the sensor to generate angular rate values/angular rate quaternion (page 26, lines 13-14; figure 8); b) integrating the angular rate values/angular rate quaternion (page 26, lines

14-15; figure 8); c) normalizing the integrated angular rate values/angular rate quaternion to produce an estimate of sensor orientation (figure 8); d) measuring a magnetic field vector to generate local magnetic field vector values (page 26, line 17; figure 9); e)measuring an acceleration vector to generate local gravity vector values (page 26, lines 9-13; figure 9); f) and correcting the estimate of sensor orientation using the local magnetic field vector and local gravity vector (page 26, lines 17-20; figure 8)."

Claims 1 and 8 have been withdrawn from consideration.

Further, the Examiner stated: "As to claims 2 and 9, Henault discloses a method of tracking the orientation of a sensor, wherein correcting the estimate of sensor orientation/estimated sensor orientation quaternion using the local magnetic filed vector and local gravity vector comprises: g) determining a measurement vector from the local magnetic filed vector values and the local gravity vector values (page 28, equations 3.21, 3.22, and 3.23; figures 8-9); h) calculating a computed measurement vector from the estimate of sensor orientation (page 29, equation 3.14); i) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function (page 29, equations 3.25 and 3.26); j) performing a mathematical operation that results in the

minimization of the criterion function and outputs an error estimate (page 29, second half, page 30 first half; figure 8); k) integrating the error estimate (figure 8); l) normalizing the integrated error estimate to produce a new estimate of sensor orientation (page 31, first half; figure 8); m) and repeating steps a) – m), wherein the new estimate of sensor orientation is used for h), calculating a computed measurement vector until tracking is no loner desired (figure 8)."

Claims 2 and 9 have been withdrawn from consideration.

The Examiner further stated: :Referring to claims 3, 10, 17, and 24-25, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4X1 quaternion error estimate comprises minimizing the criterion function without calculating the criterion function (page 34, equation 4.2) and multiplying the 6X1 error vector by the function $[X^T X]^{-1} X^T$ (equation 4.2)."

Claims 3, 10, 17, and 24 – 25 have been withdrawn from consideration.

The Examiner further stated: "As to claims 4, 11, 18, and 26, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4X1 quaternion error estimate includes implementing a partial correction step to compensate for measurement error (page 35, equation 4.4)"

Claims 4, 11, 18, and 26 have been withdrawn from consideration.

And then the Examiner stated: "Referring to claims 5, 12, 19, and 29, Henault discloses a method of tracking the orientation of a sensor, wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements (page 34, first half; equation 4.4)."

Claims 5, 12, 19 and 29 have been amended to distinguish over the reference.

Claims 5, 12, 19, and 29 as amended, are distinguished over Henault in that Henault fails to disclose the operation of performing a mathematical operation that results in the minimization of the criterion function includes implementing a partial correction step to compensate for

measurement error wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements.

Further the Examiner stated: "As to claims 6, 13, 20 and 27, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4X1 quaternion error estimate comprises using time weighted filtering (page 35, equation 4.4)."

Claims 6, 13, 20, and 27 have been withdrawn from consideration.

Further the Examiner stated: "Referring to claims 7, 14, 21, and 28, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4X1 quaternion error estimate comprises using a Gauss-Newton iteration (pages 41-42, figures 15-17)."

Claims 7, 14, 21, and 28 have been withdrawn from consideration.

Further the Examiner stated: "As to claims 15 and 23, Henault discloses a method of tracking the orientation of a sensor, the method comprising; a) providing a starting estimate of sensor orientation (figure 8); b) measuring a magnetic field vector to generate local magnetic field vector values (page 26, line 17; figure 9); c) measuring an acceleration vector to generate local gravity vector values (page 26, lines 9-13; figure 9); d) determining a measurement vector from the local magnetic field vector values and the local gravity vector values (page 28, equations 3.21, 3.22, 3.23; figures 8-9); e) calculating a computed measurement vector from the estimate of sensor orientation (page 29, equation 3.24) f) comparing the measurement vector with the computed measurement vector to generate an (6X1) error vector that defines a criterion function (page 29, equations 3.25 and 3.26); g) performing a mathematical operation that results in the minimization of the criterion function and outputs a (4X1) error estimate (page 29, second half, page 30 first half; figure 8); h) integrating the error estimate (figure 8); i) normalizing the integrated error estimate to produce a new estimate of sensor orientation (page 31, first half; figure 8); and j) repeating steps a) –j), wherein the new estimate of sensor orientation is used for e), calculating a computed measurement vector (figure 8)."

Claims 15 and 23 have been withdrawn from consideration.

Further, the Examiner stated: "Referring to claim 16, Henault discloses a method of tracking the orientation of a sensor, wherein each new estimate of sensor orientation is output as a sensor orientation signal (figure 8)."

Claim 16 has been withdrawn from consideration.

The Examiner went on to state that: "As to claims 22 and 30, Henault discloses a method of tracking the orientation of a sensor wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4X1 quaternion error estimate includes: measuring an angular velocity of the sensor to generate angular rate values (page 26, lines 13-14; figure 8); integrating the angular rate values (page 26, lines 14-15; figure 8); normalizing the integrated angular rate values to produce an estimate of sensor orientation derived from the angular rate values (figure 8); and using the estimated of sensor orientation derived from the angular rate values to correct for time lag (page 26, lines 17-20)."

Claims 22 and 30 have been withdrawn from consideration.

Further the Examiner stated: "Referring to claim 44, Henault discloses a method of determining the direction of a local gravity vector with an acceleration detector, the method comprising: moving the acceleration detector from a start point to an end point over a time period; taking measurements of the total acceleration vector during the time period; weighting summing the measurements of the total acceleration vector over the time period; and calculating gravity vector values using the weighted sum of the total acceleration measurements (page 26, lines 7-13)."

Claim 44 has been withdrawn from consideration.

New Claims 45 – 49 have been added based upon the specification reference starting at page 22, line 18. beginning with: "By aligning the coordinate axes of a sensor and a limb segment . . ." The material in the specification continues on to page 23, line 14 where the last sentence ends with: ". . .are between the body origin and the limb segment being positiond." Nowhere in the Henault reference is the use of weighted least regression disclosed. Applicant's herein state the reason why the new claims are added is to more completely cover that particular aspect of applicant's invention.

The Examiner further stated: "The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,377,906 to Rowe U.S. Patent No. 6,427,131 to McCall et al.

U.S. Patent No. 6,148,280 to Kramer U.S. Patent No. 5,807,284 to Foxlin

U.S. Patent No. 5,593,683 to Hansen et al.

U.S. Patent No. 5,645,077 to Foxlin

U.S. Patent No. 6,428,490 to Kramer et al."

The prior art made of record and not relied upon and not applied to the claims, which the Examiner considered pertinent to applicant's disclosure, has been considered but is not felt to come within the coverage of the claims now in this case.

In view of the above amendments it is believed the application is in condition for allowance. Therefore reconsideration of the present application and allowance of claims 5, 12, 19 and 29 at an early date, is respectfully requested. No additional fees are required since the number of independent claims (6) now pending do not exceed the number of independent claims (7) previously paid for and further, the number of total claims pending (9) do not exceed the number of total claims previously paid for (44).

Allowance and passage to issue at an early date are respectfully requested.

Respectfully submitted,

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